MODULAR SECURING DEVICE AND PROCESS OF LAYING SUCH A DEVICE

The invention concerns a modular securing device for road tracks and a process of laying such a device.

The securing devices are road safety devices laid on the edge of vehicle traffic lanes and intended to prevent a vehicle from driving beyond said edge. Such devices can be arranged on the side of a road or between two lanes as a lane separating device. Their securing capacity is defined by standards such as the European Standards EN 1317.1 and EN 1317.2 describing tests TB42 and TB11 whereof the level H1 corresponds to the level BT4 of the French Standard XP P98453. These tests measure the impact of a heavy vehicle (TB42) of 10,000 kg at 70 km/h at a 15° angle and of a light vehicle (TB11) of 900 kg at 100 km/h at a 20° angle. In each case, the displacement of the device must be smaller than a preset threshold for the standard to be respected.

The extent modular securing devices, regardless whether they are laid on the edge of a road or between two lanes as lane dividers, consist of modules having general trapezoid profile with a wide lower base and a narrow apex. These modules are connected together by means of bolting systems. Whereas a bolt fastening system is acceptable with a securing device mounted in a fixed position or at least for a relatively long time, the use of such systems on short duration building sites, i.e. for temporary road marking, has proved disadvantageous because of the significant assembly and disassembly time whenever such devices are placed or changed places.

The purpose of the invention is therefore to provide a modular securing device enabling simultaneously rapid placement of the elements or modules forming said device and establishing a link that is strong enough between said elements or modules so that the securing device may meet the road safety regulatory requirements as regards securing a light vehicle and a heavy vehicle according to the standards mentioned above, is case when the latter should go off the track laterally by accident.

The purpose of the invention is met by a modular securing device for road tracks comprising a set of elements elongated

along a longitudinal axis and intended to be laid on a road and connected together at their ends, each of the elements containing two end faces spaced apart longitudinally, one of the end faces being fitted with a male linking means and the other end face being fitted with a female linking means, the male and female linking means being shaped to engage into one another when laying the elongated elements.

According to the invention, the male and female linking means are shaped, in a first relative position of two elongated elements, to enable insertion of the male linking element one of both these elongated elements in the female linking element of the other of both these elongated elements and, in a second relative position of two elongated elements, to prevent these elongated elements from being disconnected.

The securing devices according to the invention consist of modules or elements having a base wide enough to ensure stable position when they are laid on a road. They may adopt various shapes and notably diverse cross sections. Preferably, the modules or elements of the securing devices according to the invention have a general trapezoid cross section with a wide lower base and a narrow apex. Still, elements having for example a general rectangular cross section can also be contemplated without departing from the framework of this invention.

According to their arrangement by the side of a road or between two lanes as lane dividers, the elements or modules have one or two profiled lateral faces.

Within the framework of this invention, the first relative position between two elongated elements is essentially that when one of both elements to be connected or, at a later stage, to be disconnected, rests on the road whereas the other elongated element is held in the air close to the element laid, in order to engage or, at a later stage, to disengage the linking means from one another. And the second relative position between two elongated elements is that both elongated elements rest on the road, the linking means being then engaged into one another.

Still, this does not mean that the first relative position of two elongated elements according to the invention would be characterised exclusively by a vertical offset of one of both these elements with respect to the other. Conversely, any other orientation of the offset can also be contemplated without departing from the framework of this invention.

Similarly, the first and second relative positions of two elongated elements according to the invention are not limited to the notion of a level offset between both elongated elements, but also include the applications when the longitudinal axes of both these elongated elements form a angle between one another and those when the linking means are shaped for bringing both these elongated elements closer at an angle when they are laid.

Contrary to the securing devices used before the invention, which form a block integral with fixed elements in order to ensure continuity of such elements, the device according to the invention consists of elongated elements connected together by linking means which, when they are engaged into one another, form a link showing an axial clearance, in order to be able to operate each element individually. The axial clearance has a value ranging between 2 mm and 12 mm, advantageously between 3 mm and 9 mm, and is typically 7 mm.

The elements used within the framework of this invention are called « elongated elements » by reason of their length which is significantly greater than that of the shorter elements, made of concrete or plastic material, used for a long time to build provisional lane dividers on building sites. Indeed, the elongated elements used within the framework of this invention have a length of the order of 6 m, a height of the order of 80 cm and a width at the base of the order of 55 cm. Their weight is of the order of 600 kg. It is intended to build these elongated elements of steel, but hollow elements, of synthetic material, that are filled or can be filled with a heavy material, can also be contemplated.

The elongated elements according to the invention have two important features as regards their efficiency, the first one being

the elasticity of the material whereof they are made and the other being their adherence to the road.

As regards the material, it must be sufficiently rigid to enable the elongated elements to sustain, during an accident, simultaneously, the impact of a vehicle as well the opening of the links between the elements of the device. At the same time, the material should not be too rigid either, so that it does not send the damaged vehicle back onto the lane. Advantageously, the elongated elements are fitted with a deformation zone situated in their lower section.

Indeed, in order to be able to lay them and to connect them simply by mechanical means, such as a crane or hydraulic grippers, the elements of the securing device according to the invention are fitted with linking means which may engage into one another only long enough for two successive elongated elements to be in a first relative position, which is generally that of an element laid with respect to an element to be laid. More particularly, the linking means of the device according to the invention may only engage into one another as long as the corresponding ends of two successive elongated elements, generally therefore of an element laid and of an element to be laid, are situated at different preset levels. The movement of one of these elements toward the other, already laid, is used to engage, without calling for the intervention of a person remaining on the lane, the linking means into one another.

When both elongated elements are laid, they are in the second relative position, wherein the link is effective and should only be opened when the one of both these elongated elements which was laid first, is moved, for example to a preset level, so that both elements are again in the first relative position. Failing which, the requirements of the standards indicated above are not respected. In addition to the selection of an adequate shape of the linking means enabling to lay and to connect together these elongated elements without the intervention of a person on the ground, these linking means must be formed and/or fixed to the

ends of each of the elongated elements so that the link cannot be opened when said means are torn or deformed. This calls hence for a certain rigidity of the material selected for the realisation of the elongated elements.

At the same time, the material must be sufficiently elastic to absorb at least partially the kinetic energy developed during an accident, notably to prevent said energy from being supported entirely by the linking means.

As regards the adherence of the elongated elements to the road, it constitutes a significant feature inasmuch as it contributes, together with the elasticity of material of the elongated elements, to prevent the elongated elements from being displaced excessively in case of an accident. Indeed, the more the elongated elements are displaced due to the impact of a vehicle, the more the kinetic developed during such accident must be sustained by the linking means. Beyond an impact threshold relative to the adherence of the elongated elements and their capacity to absorb such kinetic energy, said energy must be sustained by the links between the elements, which might cause some of these links to break.

To avoid such a situation and to ensure the adherence necessary to meet the criteria of the road tests mentioned above, each elongated element is made of a very heavy material and exhibits therefore high adherence in itself. Moreover, each of the elongated elements is provided, on the face whereby it rests on the ground, with adherence-increasing means, such as non-slipping skids, made for instance of an elastomer material such as synthetic rubber. Each of the skids is integral with the elongated element. Advantageously, at least the back-up face of the skids, whereby they are in contact with the road lane, is substantially flat. According to an embodiment variation, these skids are also fitted with studs.

The skids may be positioned either at a quarter of the length of the elongated element, measured from either end of the element, or still at one of its ends and in the middle of the elongated element. When a greater number of skids are used, their

arrangement must be adapted in order to provide homogeneous distribution over the whole length of the securing device formed by the elongated elements assembled.

The securing device according to the invention meets the requirements of the European and French standards mentioned above and reaches at least the French securing level BT4 and the corresponding European level H1.

As regards the link between the different elongated elements of the device of the invention, the design suggested by the invention differs from the former realisations, notably integral blocks obtained for example by bolting, by the introduction of an axial clearance (according to the orientation of the linking means) or a longitudinal clearance (according to the direction of the elongated elements) in the link between the different elongated elements. Thus, each elongated element may first work individually before dragging along the following element when fulfilling its function as a securing device.

To this end, the female linking means consists of one or several openings made in one of both end faces of each of the elongated elements and the male linking means consists of one or several hooking elements formed or mounted on the other end face of each of the elongated elements. The accurate shapes of the openings and of the hooking elements are little relevant as long as they are selected so that these linking means may engage into one another, or may be disconnected from one another, only as long as the elongated elements affected are in the first relative position and that the elongated elements affected are prevented from coming apart as long as they are in the second relative position.

For the implementation of this linking principle, which elongated element whereon the male linking means and the female linking means, respectively, are situated, is irrelevant. Indeed, the most current embodiment will be that when the opening and the hooking means are formed so that the hooking means mounted on one end face of an elongated element to be laid may be engaged into the opening made in an end face of an elongated element

already laid. The opening will then be wider at the top than at the bottom so that the hooking means may be engaged into the opening when the element to be laid is in the first relative position with respect to the element already laid, i.e. in suspension, but may not come out of the said when both elongated elements are in the second relative position, i.e. both are laid.

However, it is also conceivable that the opening should be engaged onto the hooking means. In such a case, the opening will be wider at the bottom than at the top.

In the case of an elongated element of prismatic shape, whereof the cross section corresponds approximately to a trapezoid with a narrow apex or to a triangle, the recommended number of openings is three whereof one is arranged at an upper level and two are arranged at a lower level. The number of hooking elements must obviously correspond to that of the openings.

Whatever the number of linking means and the way they are engaged, the openings and the corresponding hooking elements must have such a shape and sizes that, to provide a link between two successive elongated elements, an elongated element must be brought, using a crane, closer to an element already laid and engage the hooking elements of the one element into the openings of the other element before laying the elongated element on the road. The disconnection of two elongated elements considered unfold in the reverse order: a given elongated element is lifted by a crane at least at the end where the disconnection should be made and is situated at a distance from the following element remaining in position in order to extract the hooking elements from one of the openings of the other elongated element.

Other features and advantages of the invention will appear in the description of an embodiment provided hereunder with reference to the appended drawings.

On these drawings,

Figures 1 and 2 show perspective views of an elongated element according to the invention respectively from one and from the other of both its ends.

Figure 3 shows the elongated element of Figure 2 as a top view.
Figure 4 shows the elongated element of Figure 1 from its end face.
Figure 5 shows the end face of Figure 4 as a lateral view.
Figure 6 shows the elongated element of Figure 2 from its end face.
Figure 7 shows the end face of Figure 6 as a lateral view.
Figure 8 shows a hooking means as an axial section.
Figure 9 shows an inner profile of the elongated element according to the invention, as a front view.
Figure 10 shows the inner profile of Figure 9 as a lateral view, and
Figure 11 shows a modular securing device according to the invention.

The modular securing device according to the invention comprises a set of elements elongated along a longitudinal axis and intended to be laid on a road. Within the framework of this description, an elongated element already laid is referred to as 1 and an elongated element to be laid, besides identical to the element 1, is referred to as 1A. The elongated elements 1 and 1A are connected together at their ends 2, 3 using a female linking means 4 provided on the first end 2 and using a male linking means 5 provided on the second end 3. The female linking means 4 and the male linking means 5 are formed in order to engage into one another by the inherent movements when laying the elongated elements 1 and 1A, as will be explained thereafter.

In the embodiment represented on Figures 1 and 4, the female linking means 4 consists of three elongated openings 4.1, 4.2, 4.3 made in a face 131 of the end 2 of the elongated element 1. Each of these openings exhibits an upper circular section and a lower section, in the alignment of the upper section downwards, whereof the width is smaller than the diameter of the upper section.

According to variations non represented, the female linking means 4 may also comprise, for example, triangular openings whereof each triangle is positioned so that one of its angles is oriented downwards and the opposite side of the triangle extends

horizontally, or still by openings having a rectangular section with a first width which is extended by a rectangular section with a second width smaller than the first.

The male linking means 5, represented on Figures 2 and 6 to 8, consists of three cylindrical elements 5.1, 5.2 and 5.3, mounted on one end face 111 of the end 3 of the elongated element 1. Each of these cylindrical elements 5.1, 5.2, 5.3 comprises a body in two sections, i.e. a base 51 having a diameter D1 and an intermediate section 52 having a diameter D2, smaller than D1, as well as a truncated head 53 having a large diameter D3 and a small diameter D4. Advantageously, the large diameter D3 corresponds to the diameter D1.

In the chronological order of their engagement into both sections of the openings forming the female linking means 4, the sections of the cylindrical elements forming the male linking means 5 have the following cross sections, with respect to their longitudinal axis: the head 53 has a first section characterised by the diameter D3 and able to run through the upper section of the opening ; the intermediate section 52 has a second section characterised by the diameter D2 and able to engage into the lower section of the opening ; and the base 51 has a third section characterised by the diameter D1 which is greater than the diameter D2, but which has no relation with the diameter D3 whereas, in the embodiment represented, it is equal to the diameter D3.

The head 53 whereof the shape, here truncated, has no other function than making the engagement of the linking element 5 into the opening 4 easier and which forms the free end of the elements 5.1, 5.2, 5.3, is thus spaced apart axially from the base 51 by the intermediate section 52. According to another aspect, the head 53 is separated from the base 51 by an annular groove 54 surrounding the intermediate section 52. The axial length L2 of the groove 54, or of the intermediate section 52, is determined so that, when the male linking means is engaged into the female linking

means, an axial clearance between the two elongated elements thus connected remains.

The axial length and the diameters of the cylindrical elements 5.1, 5.2, 5.3 are determined with respect to the dimensions of the openings 4.1, 4.2, 4.3 and in relation to the features of the material, notably its thickness, selected for their realisation. For exemplification purposes, the following sizes are given: D1 and D3 approx. 80 mm, D2 approx. 40 mm, D4 approx. 20 mm and total length L1 of a cylindrical element 5.1, 5.2 or 5.3 approx. 95 mm. The length L2 of the intermediate section 52 is 25 mm for a thickness of 8 mm of the material wherein are formed the openings 4.1, 4.2, 4.3 and for an axial clearance of 7 mm.

The sizes of the openings 4.1, 4.2 and 4.3 are slightly greater than the corresponding diameters of the head 53 and of the intermediate section 52 of the elements 5.1, 5.2 and 5.3. For exemplification purposes, the diameter of the upper section of the openings is 90 mm for the diameter D3 (80 mm) of the head 53 and the width of the lower section of the openings 4.1, 4.2 and 4.3 is 44 mm for the diameter D2 (40 mm) of the intermediate section 52.

When assembling the modular securing device according to the invention, an elongated element 1A is transported, using a mobile crane or a semi-crane, fitted with hydraulic grippers, towards an elongated element 1 already in place and the elongated element 1A is brought, by its end fitted with the male linking means 5, close to the elongated element 1 already laid and exhibiting the end 2 fitted with the female linking means 4, while keeping the first elongated element 1A in the first relative position with respect to the elongated element 1, i.e. suspended until the elements 5.1, 5.2 and 5.3 are engaged into the openings 4.1, 4.2 and 4.3. Then, the elongated element 1A is placed in the second relative position with respect to the elongated element 1. When lowering the elongated element into its final position, the heads of the elements 5.1, 5.2 and 5.3 engage into the lower respective section of each of the openings 4.1, 4.2 and 4.3. Taking into account the shape of the h ads of the elements 5.1, 5.2 and 5.3 and of the way these

elements engage into the openings 4.1, 4.2 and 4.3, it can be said that the elongated elements of the modular securing device according to the invention, are connected together by « bolting ».

This linking principle enables on the one hand, to lay the elements using mobile cranes or semi-cranes without any staff on the ground, which improves considerably the safety of the staff on the building site during all the handling steps of the elements of the modular securing device. On the other hand, the laying may be performed with a working speed of the order of 200 linear metres per hour and per semi-crane.

As regards the design of the elongated elements 1 properly speaking, the embodiment represented on Figures 1 to 9 is that of an assembly of two slides 6, 7 of steel forming two profiled lateral elongated faces and of two end connectors 11, 13 comprising the two end faces respectively 111 and 131, brought together in order to form a prismatic element.

Each of the slides 6, 7 consists of two standardised profiles referred to respectively as 6.1, 6.2 for the slide 6 and 7.1, 7.2 for the slide 7. The use of standard slides ensures quick repair if required. The slides are connected at their ends by both end connectors 11, 13. Between both these ends, the slides 6 and 7 are connected together by means of three intermediate connectors 12. The profiles forming the slides 6 and 7 are made of steel whereof the alloy is determined so that, in case of an accident, these profiles, and notably the lower profiles 6.2, 7.2, may absorb the kinetic energy transmitted to the slides, partially in deformation zones provided essentially between the end connectors 11, 13 and the intermediate connector 12. A remaining section of said energy is absorbed by the limited displacement of the elongated elements. This admitted deformation, the admitted displacement and the resistance to the opening of the links between the elongated elements form a set of features of the securing device adapted to one another so that the device may meet the requirements of the safety standards mentioned above.

Advantageously, the securing device according to the invention is completed on each of its lateral faces, by a metallic rail 18, 19 which, for better visibility, is painted in yellow. The device may be fitted, moreover, with reflecting elements for better night visibility.

Both end connectors 11 and 13 and the three intermediate connectors 12 consist of steel sheet profiles formed in order to exhibit on the one hand a face which is approximately triangular, apart from the upper truncated section, as represented on Figures 4, 6 and 9, and on the other hand, respective lateral sections represented on Figures 5, 6, 7 and 10, which are fitted with assembly openings 15.1, 15.2 and 15.3 and 17 for fastening the slides.

The elongated elements are fitted with means 9 increasing the adherence of the elongated element 1 to the road. These means 9 consist of non-slipping skids 9 whereof both of them are arranged on the lower face of one of both end connectors 11, 13 (Figure 6 shows them under the end connector 11) and whereof the other two skids are fixed below the intermediate connector 12 closest to the end connector 13, as indicated on Figure 3. Advantageously, each of the skids 9 is in the form of a block of synthetic rubber fixed to a metal plate by means of which the skid is mounted below the elongated element 1. The back-up face of each of the skids 9 has sizes of the order of 125 mm x 125 mm. Other sizes may also be necessary in relation to the synthetic rubber selected.

According to an embodiment variation, the skids 9 are fitted with studs whereof the length is selected so that they protrude slightly from the back-up face of the rubber block.

The elongated elements 1 of the securing device according to the invention are designed so that the assembly and the installation can be performed on a single traffic lane, thereby avoiding the immobilisation of a second lane. Moreover, their weights and sizes enable to transport a batch of at least twenty

four elongated elements, representing a minimum length of 144 m securing device, over a 22 ton trailer crane.